AU9464645

(12) PATENT ABRIDGMENT (11) Document No.. AU-B-64645/94
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 677649

(54) Title
A SANDWICH PANEL

International Patent Classification(s)
(51)[5] **E04C 002/34** **E04B 002/82** **E04C 002/38**

(21) Application No. : **64645/94** (22) Application Date : **09.06.94**

(30) Priority Data

(31) Number	(32) Date	(33) Country
PL9376	**11.06.93**	**AU AUSTRALIA**

(43) Publication Date : **15.12.94**

(44) Publication Date of Accepted Application : **01.05.97**

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(56) Prior Art Documents
AU 28488/92 E04B 001/61 E04C 002/34 E04C 2/52
AU 638644 19358/92 E04B 002/74 E04C 2/34 E04C 3/28
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(57) Claim

1. A composite panel comprising at least two generally planar laminates, and at least two structural frame elements disposed in non-parallel relationship, between or closely adjacent said laminates, said panel being adapted for connection to one or more like panels to form a panel assembly wherein the respective frame elements interact to form an integrated internal framework providing structural support.

AUSTRALIA

PATENTS ACT 1990

C O M P L E T E S P E C I F I C A T I O N

FOR A STANDARD PATENT

O R I G I N A L

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Invention Title: "A SANDWICH PANEL"

Details of Associated Provisional Application No: PL9376 dated 11th June 1993

The following statement is a full description of this invention, including the best method of performing it known to me:-

The present invention relates to composite panels, and in particular to a panel of the type adapted for connection to like panels to form a composite panel assembly.

The invention has been developed primarily for use in the building industry in the manufacture of walls, partitions, ceilings, floors and the like and will be described hereinafter with reference to this application. It will be appreciated, however, that the invention is not limited to this particular field of use.

In the building industry, walls are normally fabricated by first erecting a structural framework which is usually formed from wood or steel. The framework is subsequently clad with a suitable laminate such as plasterboard or gyprock, which is then finished and painted. The problems with this technique are that it is particularly labour intensive and costly, it involves the use of several specialised trades, and once a wall has been built, it must be substantially demolished to be removed so the constituent materials are wasted.

In order to ameliorate these problems, the use of composite panels has been proposed. Such panels are well known and in the past have been fabricated from a variety of different materials to achieve desired strength to weight characteristics, insulation properties, surface finishes, and the like. A major

problem, however, has been that with known fabrication techniques, there is a practical limit to the maximum size of individual panels. This has led to various techniques for joining individual panels to form composite planer assemblies. However, in the past, the joints between adjacent panels have been relatively weak and the resultant loss of structural integrity has meant that in practice, the potential strength to weight characteristics offered by composite panels have not been realised in many applications.

It is therefore an object of the present invention to provide an improved composite panel which overcomes or substantially ameliorates at least some of these disadvantages of the prior art.

Accordingly, the invention as presently contemplated provides a composite panel comprising at least two generally planar laminates, and at least two structural frame elements disposed in non-parallel relationship, between or closely adjacent said laminates, said panel being adapted for connection to one or more like panels to form a panel assembly wherein the respective frame elements interact to form an integrated internal framework providing structural support.

In the preferred embodiment the frame elements interlockingly intersect within the panel at intersection points and are disposed generally orthogonal to each other. Preferably, the panel comprises a core laminate sandwiched between at least two surrounding outer laminates.

Preferably also, the outer laminates protrude beyond the core by a predetermined margin along a first edge of the panel, and the core protrudes beyond the outer laminates by a corresponding margin along an opposite edge of the panel. In this way, the protruding outer laminate portions of each panel are adapted nestingly to receive and

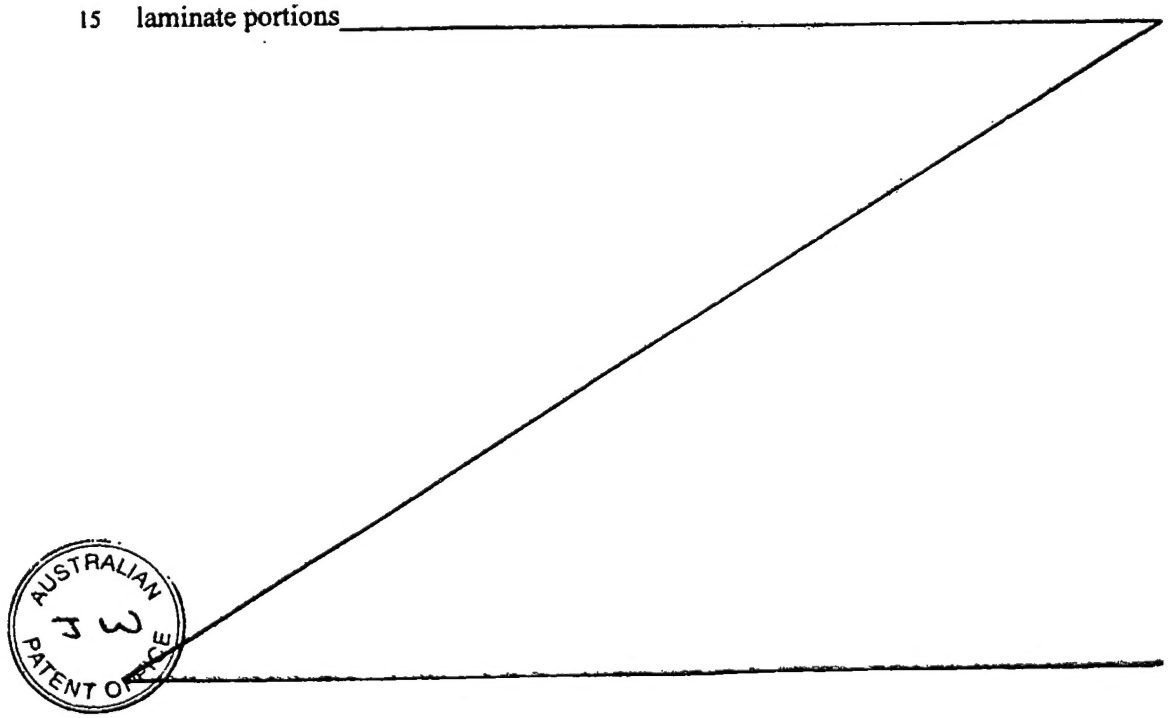
locate the corresponding protruding core portion of an adjacent panel in an overlapping tongue and groove configuration.

In the preferred embodiment, the protruding core portion is enclosed by a corresponding generally U-shaped first channel member such that the channel flanges lie in planes parallel to and immediately adjacent the respective outer laminates, and the channel web extends between the flanges in a plane substantially normal thereto.

Preferably, each such channel defines a respective first one of said frame elements.

Also preferably, the second frame element is in the form of a second generally U-shaped channel extending through the core intermediate the outer laminates in a direction substantially normal to the first channel.

In this embodiment, the web of each second channel is preferably rebated adjacent said first edge into flush relationship with the recessed core, such that residual flange portions protruding beyond the core define a corresponding pair of exposed connecting tongues extending respectively along the inner surfaces of the surrounding outer laminate portions



The first channel extending along the opposite edge of each panel is preferably formed with a corresponding pair of recessed grooves such that upon engagement with a like panel, said connecting tongues are nestingly received and located within the respective grooves, intermediate the corresponding flanges of the first channel and the surrounding laminates of the adjoining panel.

Preferably, upon assembly, the connecting tongues are releasably fastened in position within the respective grooves by self-tapping screws, each of which extends through the respective outer laminate, connecting tongue, first channel web, and into the core, such that the intersecting first and second channels are respectively connected to form the integrated internal framework.

Preferably, the core incorporates appropriately spaced preformed ducts, to facilitate concealed internal routing of utilities such as water pipes, electrical cables, phone lines, or the like.

In the preferred embodiment, the core is formed from expanded polystyrene foam to provide structural rigidity, weight reduction and sound attenuation. The surrounding laminates are preferably formed from a suitable cladding material such as plasterboard or gyprock to provide the desired surface finish and fire rating characteristics for domestic or industrial applications, as may be required. The gyprock is

preferably bonded to the foam core by a suitable cross-linking type of moisture-curing adhesive.

A preferred embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:-

Figure 1 is a perspective view showing a composite panel according to the invention;

Figure 2 is a cross-sectional plan view showing two such panels interconnected to form part of a wall;

Figure 3 is a cross-sectional end elevation taken along line 3-3 of Figure 2, showing a typical vertical panel section and brackets for securing the panel assembly to the floor and ceiling;

Figure 4 is an enlarged perspective view of the first channel section normally containing the protruding core portion of the panel of Figure 1;

Figure 5 is a perspective view showing a second embodiment of the invention, wherein like panels having interlocking longitudinally extending edge flanges are joined to form a section of flooring;

Figure 6 is a perspective view showing a third embodiment of the invention, having four corresponding pairs of tongue and groove formations;

Figure 7 is a cut-away perspective view of the third embodiment of the invention shown in Figure 6; and

Figure 8 is a perspective view of the third embodiment of the invention prior to joining two composite panels together.

Referring firstly to Figure 1, the invention provides a composite panel 1 comprising a central core laminate 2 sandwiched between surrounding outer laminates 3. The core is preferably formed from expanded polystyrene foam, whilst the outer laminates are formed from a suitable cladding material such as plasterboard or gyprock, bonded to the core with an appropriate cross-linking type of moisture curing adhesive.

The outer laminates 3 extend beyond the core 2 by a predetermined margin A along a first edge 6 of the panel, whilst on the opposite edge 7 of the same panel, the core extends beyond the outer laminates by a corresponding margin in a tongue and groove configuration, as described in more detail below.

As best seen in Figure 2, the protruding core portion 9 is enclosed by a corresponding generally U-shaped first channel member 10 such that the channel flanges 11 lie in planes parallel to and immediately adjacent the respective outer laminates 3. In the preferred embodiment, it will be seen that the marginal edges of these flanges 11 are sandwiched between the core and the respective outer laminates, whilst the channel web 12 extends intermediate the flanges in a plane substantially normal to the panel. The first channel 10, as well as encapsulating the protruding core portion 9, functions as a first structural frame element 15.

Each panel further incorporates a second structural frame element 16 in the form of a second generally U-shaped channel 17 extending through the core, intermediate the outer laminates, in a direction substantially normal to the longitudinal extent of the first channel 10. As best seen in Figure 1, a section of the web 18 of the second channel is cut away by an amount corresponding to distance A such that the marginal edge of the web is rebated adjacent the first edge 6 of the panel into flush relationship with the recessed core. In this way, the residual flange portions protrude beyond the core to define a pair of exposed connecting tongues 20 extending respectively along the inner surfaces of the surrounding outer laminates 3.

As best seen in Figure 4, the first channel 10 extending along the opposite edge 7 of each panel is formed with a complementary pair of recessed grooves 21. The grooves 21 are shaped nestingly to accommodate the corresponding tongue formations 20 of a like panel.

In a third embodiment of the invention shown in Figures 6 to 8, each frame element 16 is replaced with a corresponding pair of metal straps 20, disposed on opposite sides of the core. These function in the manner described previously but have no interconnecting web 18.

Turning now to describe the method of connection, and with particular reference to Figure 2, two or more

like panels are first aligned such that the first edge 6 of each panel is presented to the opposite edge 7 of an adjacent panel. The panels are then engaged whereby the protruding core portion 9 and surrounding channel 10 are nestingly received and located by the corresponding outer laminate portions of the adjacent panel in an overlapping tongue and groove configuration. It will be appreciated that upon engagement of the panels, the connecting tongues 20 are simultaneously received and located within the respective grooves 21 intermediate the flanges 11 of the first channel and the surrounding outer laminates 3.

With the panels thereby assembled with an interference fit, the connecting tongues 20 are fastened in position within their grooves 21 by self-tapping screws (not shown). Each screw extends through the respective outer laminate 3, the underlying tongue 20, the first channel flange 11 behind the groove 21, and then into the core. In this way, it will be appreciated that the respective interlocking first and second channels 10 and 17 are securely connected in orthogonal relationship. Following this procedure, any number of like panels can be connected to form a panel assembly 25 of the desired size and shape.

Once assembled, the panels can be retained in position as a wall section by complementary angled brackets 26 and 27 adapted to be secured to the floor

and ceiling respectively. As best seen in Figure 2, an edge capping channel 28 is provided to terminate the end panel abutting a perpendicular wall, whilst various end fittings 29 are adapted for connection to the opposite end of the wall section, again by self-tapping screws, to define door and window jams, or the like. Conventional jointing techniques can then be used if desired to conceal the joints between abutting sections of outer laminate, prior to painting or finishing.

The core laminate 2 can be provided with preformed horizontally and/or vertically extending ducts 30 to facilitate concealed internal routing of gas and water pipes, electrical cables, telephone lines, and the like.

It will be appreciated that in the panel assembly formed in accordance with this method, the first panel members 10 form an array of vertically extending upright structural supports, whilst the second channel segments 17 are effectively joined by the self-tapping screws upon assembly, to form an array of effectively continuous horizontally extending structural members. In this way, the vertical and horizontal channel members together form a self contained, integrated, internal framework providing structural support for the composite assembly.

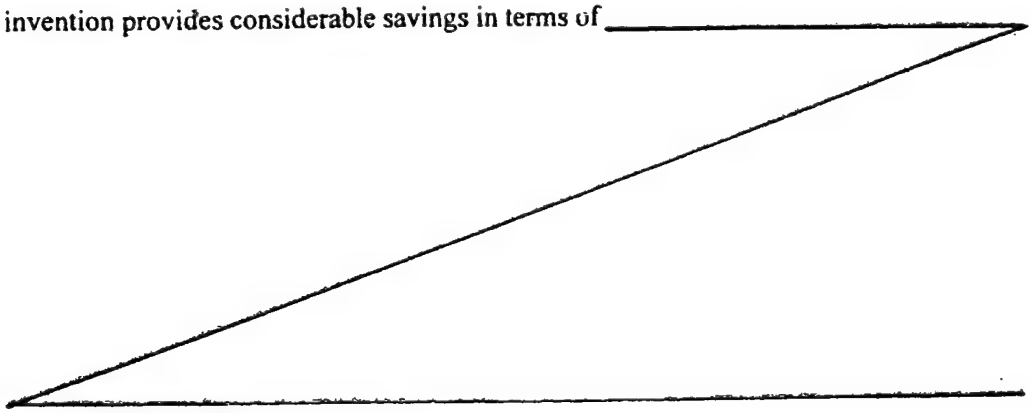
A second embodiment of the invention is shown in Figure 5, wherein corresponding features are denoted by corresponding reference numerals. In this case, each

panel 1 is adapted for connection to like panels to form a floor section 40. It will be apparent from the drawing that the complementary longitudinally extending edge flanges 32 and 33 interlock to join adjacent panels together, whilst forming a structural framework to strengthen the joint. In this case, the upper laminate is preferably formed from fibro-cement, whilst the lower laminate or core is formed from pressed metal sheeting or other suitable materials. A suitable material for the lower laminate is sold under the trade name "BONDEK". Again, appropriate edge fittings can be provided as required where the floor abuts adjacent walls. The panels can also be joined with self-tapping screws or the like to provide an additional degree of mechanical interengagement and structural integrity.

A third embodiment of the invention is shown in Figures 6 to 8, wherein corresponding features are denoted by common reference numerals.

In this embodiment, the composite panel has four pairs of grooves 21 shaped nestingly to accommodate the corresponding tongue formations 20 of a like panel. This embodiment also includes additional horizontally and vertically extending ducts 30. The nesting interengagement of like panels is shown in phantom in Figure 8.

It will be appreciated that by not requiring the separate assembly of a structural frame, followed by the time consuming application of surrounding cladding, the invention provides considerable savings in terms of



on-site assembly time and construction cost. Other advantages include reduced weight per unit area, improved sound attenuation, and reduced overall fabrication cost. Moreover, the system can be readily dismantled if the wall or floor needs to be relocated, removed, or replaced, and the same panels re-used indefinitely in other locations and configurations. This is in contrast with conventional fabrication techniques, whereby existing walls must generally be demolished with consequential wastage of the constituent materials. As well as the obvious cost benefits, this facility affords significant environmental advantages in terms of the recyclability of the basic materials. Thus, the invention represents a significant improvement over the prior art.

Although the invention has been described with reference to specific examples, it will be appreciated by those skilled in the art that the invention may be embodied in many other forms. In particular, it should be appreciated that the panels may be used to form walls, ceilings, floors, doors, partitions, and any other suitable generally planar structures.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. A composite panel comprising at least two generally planar laminates, and at least two structural frame elements disposed in non-parallel relationship, between or closely adjacent said laminates, said panel being adapted for connection to one or more like panels to form a panel assembly wherein the respective frame elements interact to form an integrated internal framework providing structural support.

2. A composite panel as claimed in claim 1, wherein said frame elements intersect within the panel.

3. A composite panel as claimed in claim 2, wherein said frame elements interlock at intersection points.

4. A composite panel as claimed in any one of the preceding claims wherein said frame elements are disposed in generally orthogonal relationship.

5. A composite panel as claimed in any one of the preceding claims comprising a core laminate sandwiched between at least two surrounding outer laminates.

6. A composite panel as claimed in claim 5, wherein the outer laminates protrude beyond the core by a predetermined margin along a first edge of the panel, and the core protrudes beyond the outer laminates by a corresponding margin along an opposite edge of the panel.

7. A composite panel as claimed in claim 6, wherein the protruding outer laminate portions of each panel are adapted nestingly to receive and locate the corresponding protruding core portion of an adjacent panel in an overlapping tongue and groove configuration.

8. A composite panel as claimed in claim 7, wherein the protruding core portion is enclosed by a corresponding generally U-shaped first channel member such that the first channel flanges lie in planes parallel to and immediately adjacent the respective outer laminates, and the first channel web extends between the flanges in a plane substantially normal thereto.

9. A composite panel as claimed in claim 8, wherein the first channel defines a respective first one of said frame elements.

10. A composite panel as claimed in claims 8 or 9, wherein a second generally U-shaped channel extends through the core intermediate the outer laminates in a direction substantially normal to the first channel to define a second of said frame elements.

11. A composite panel as claimed in claim 10, wherein the web of each said second channel is rebated adjacent said first edge into flush relationship with the recessed core, such that residual flange portions protruding beyond the core define a corresponding pair of exposed connecting tongues extending respectively along the inner surfaces of the surrounding outer laminate portions.

12. A composite panel as claimed in claims 8 or 9, wherein at least one strap extends through the core intermediate the outer laminates in a direction generally normal to the first channel to define a second of said frame elements.

13. A composite panel as claimed in claim 12, including at least one pair of said straps disposed such that residual strap portions protruding beyond the core define a corresponding pair of exposed connecting tongues extending respectively along the inner surfaces of the surrounding outer laminate portions.

14. A composite panel as claimed in claim 12 or claim 13, wherein the first channel extending along the opposite edge of each panel is formed with a corresponding pair of recessed grooves such that upon engagement with a like panel, said connecting tongues are nestingly received and located within the respective grooves, intermediate the corresponding flanges of the first channel and the surrounding laminates of the adjoining panel.

15. A composite panel as claimed in claim 14, wherein the connecting tongues are releasably fastened in position within the respective grooves by self-tapping screws, each of which extends through the respective outer laminate, connecting tongue, first channel web, and into the core, such that the intersecting first and second channels are respectively connected to form the integrated internal framework.

16. A composite panel as claimed in any one of claims 1 to 15, wherein the core incorporates preformed ducts, to facilitate concealed internal routing of utilities such as water pipes, electrical cables, phone lines, or the like.

17. A composite panel as claimed in any one of claims 1 to 16, wherein the core is formed from expanded polystyrene foam.

18. A composite panel as claimed in any one of claims 1 to 17, wherein the surrounding laminates are formed from a cladding material such as plasterboard or gyprock.

19. A composite panel as claimed in claim 18, wherein the gyprock or plasterboard is bonded to the foam core by a cross-linking type of moisture-curing adhesive.

20. A composite panel as claimed in any one of claims 14 to 19, further comprising four pairs of said grooves and their corresponding tongue formations.

21. A composite panel as claimed in claim 20, further comprising additional horizontally and vertically extending ducts.

22. A composite panel as claimed in claim 1, adapted for connection to like panels to form a floor section.

23. A composite panel as claimed in claim 22, comprising complementary longitudinally extending edge flanges which interlock to join adjacent panels.

24. A composite panel as claimed in claim 23, wherein said interlocking edge flanges form said integrated internal framework.

25. A composite panel as claimed in any one of claims 22 to 24, wherein one of the laminates is formed from fibro-cement and the other of the laminates is formed from pressed metal sheeting or other suitable material.

26. A composite panel substantially as hereinbefore described with reference to Figures 1 to 4, 5 or 6 to 8 of the accompanying drawings.

DATED this 13th Day of February, 1997

NABIL NASRI GAZAL

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Fellow Institute of Patent Attorneys of Australia
of SHELSTON WATERS

ABSTRACT

A composite panel (1) comprising at least two generally planer laminates (2,3), and at least two structural frame elements (15) disposed normal to each other and within or closely adjacent the laminates (2,3). The panel is adapted for connection to one of more like panels to form a panel assembly (25). The respective frame elements (15,16) interact to form an integrated internal framework and thereby provide structural support for the panel assembly (25).

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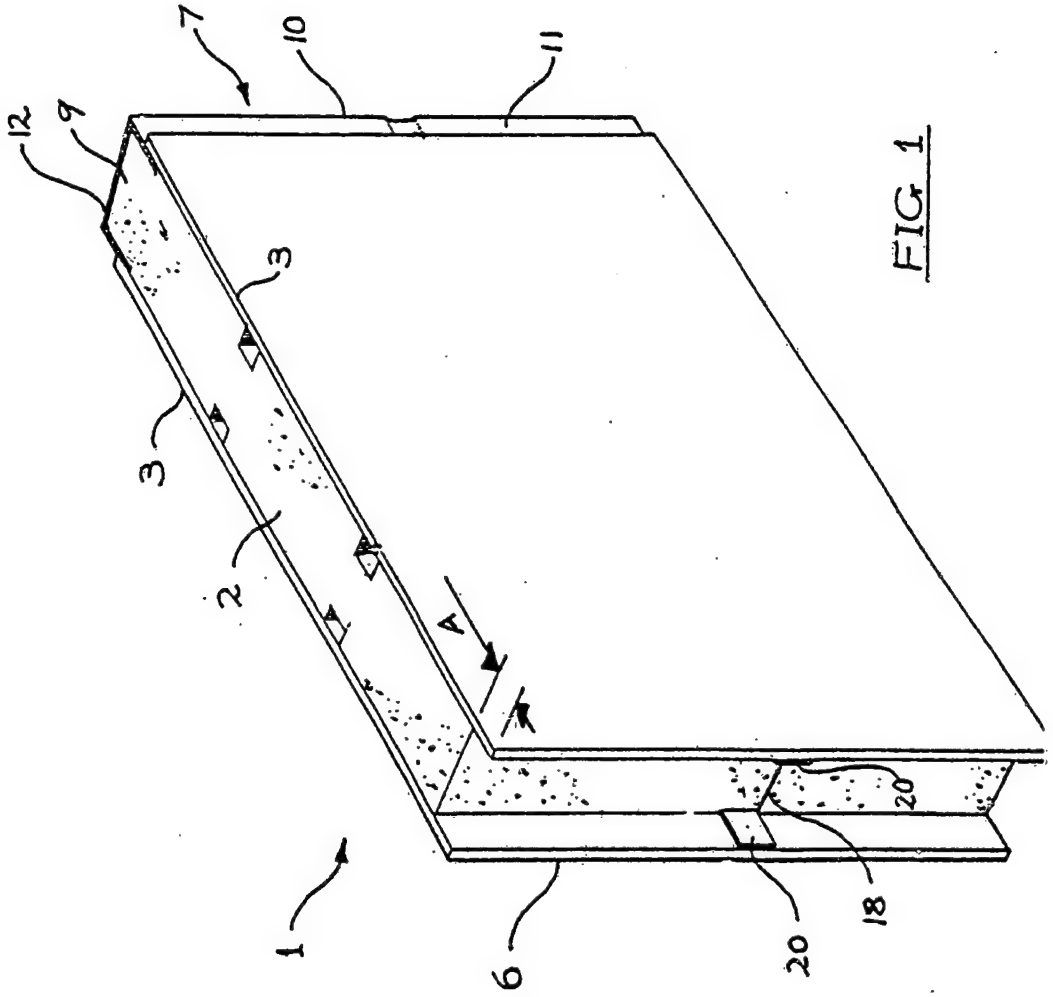

FIG 1

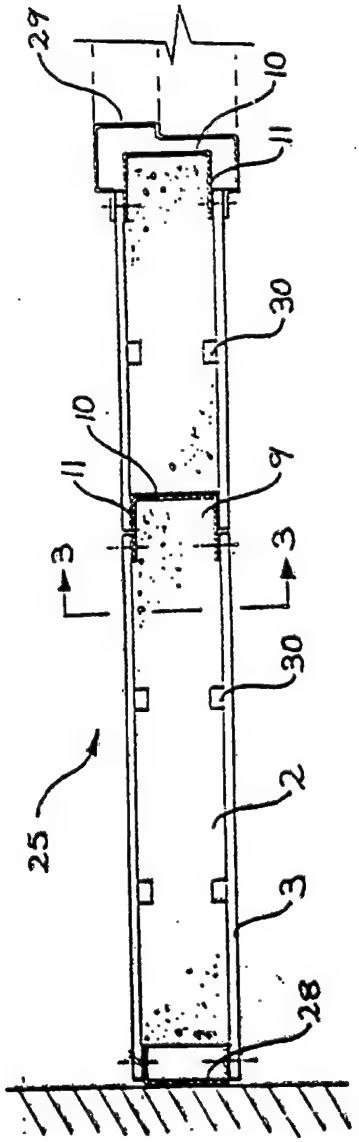

FIG 2

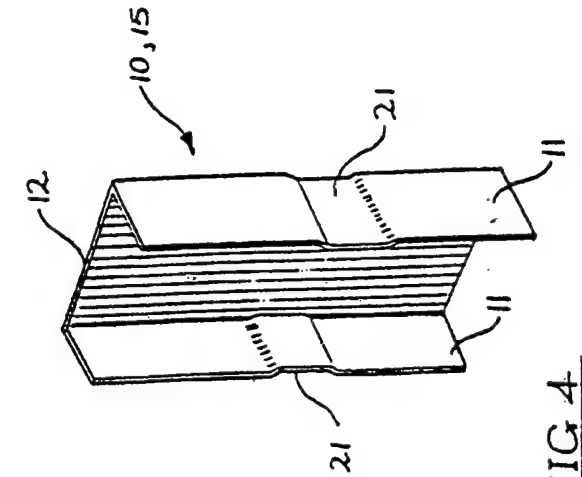

FIG 4

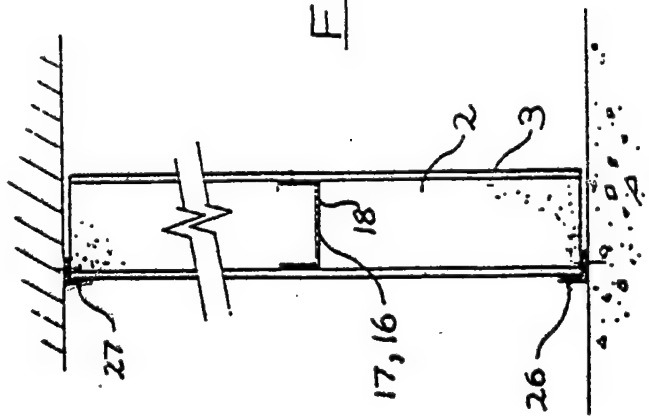

FIG 3

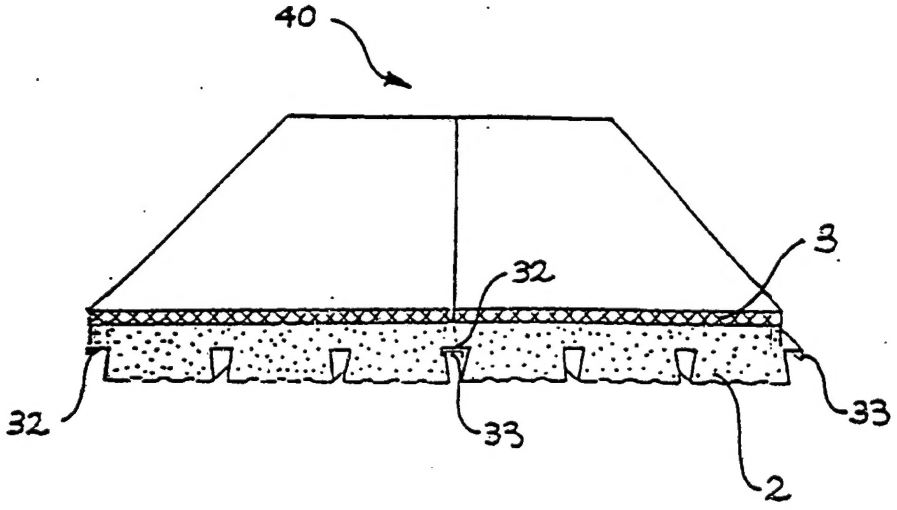

FIG 5

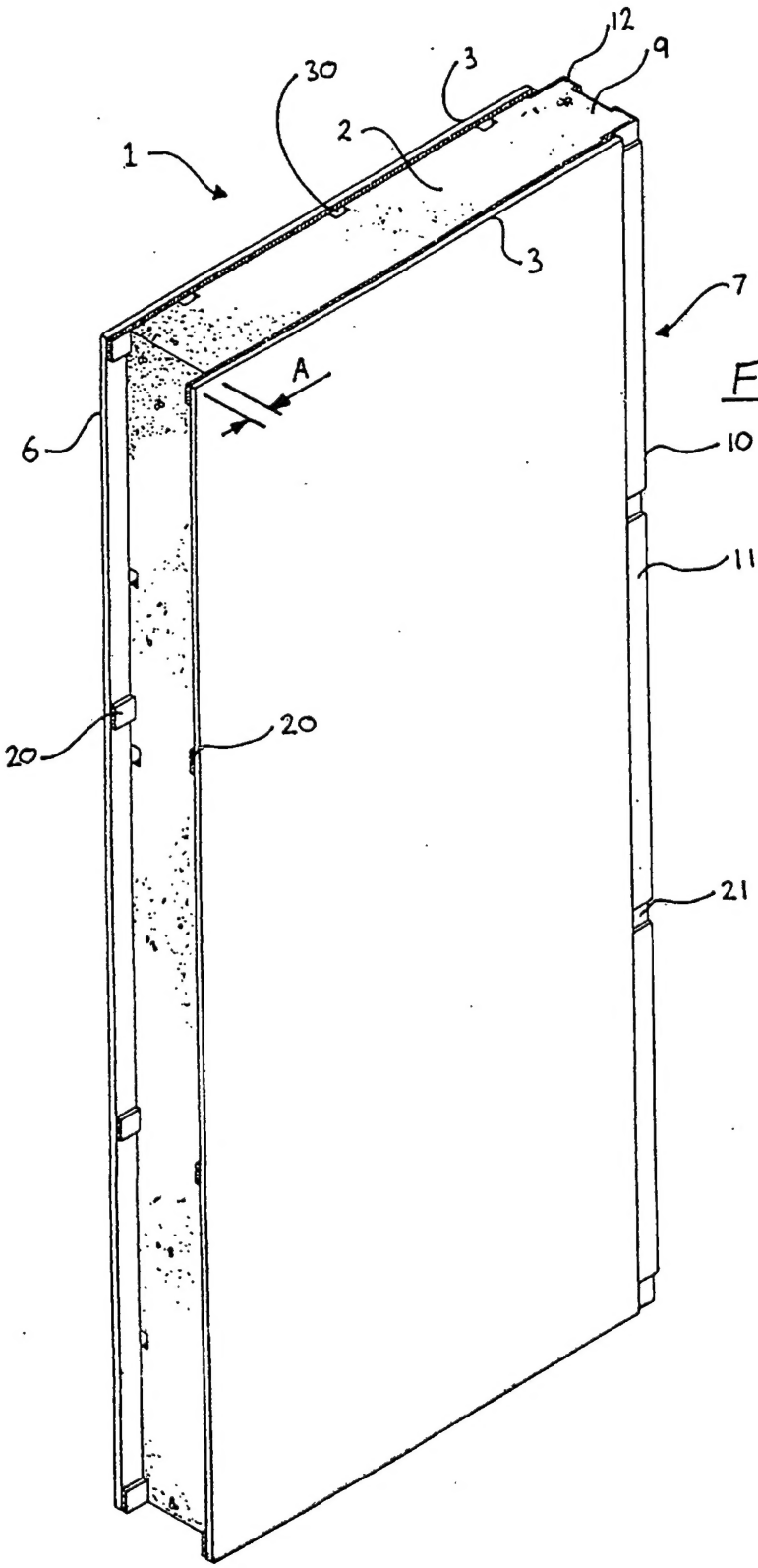

FIG 6

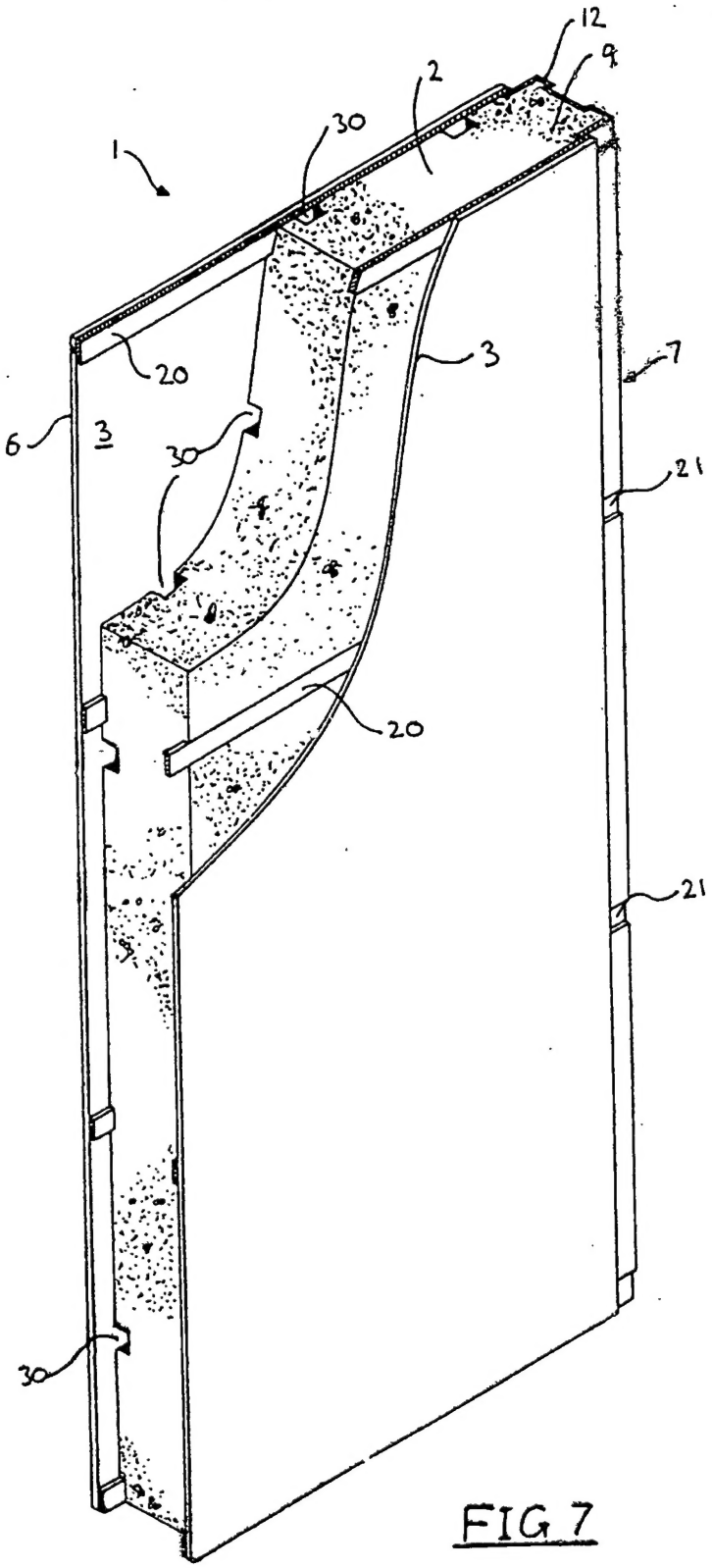

FIG 7

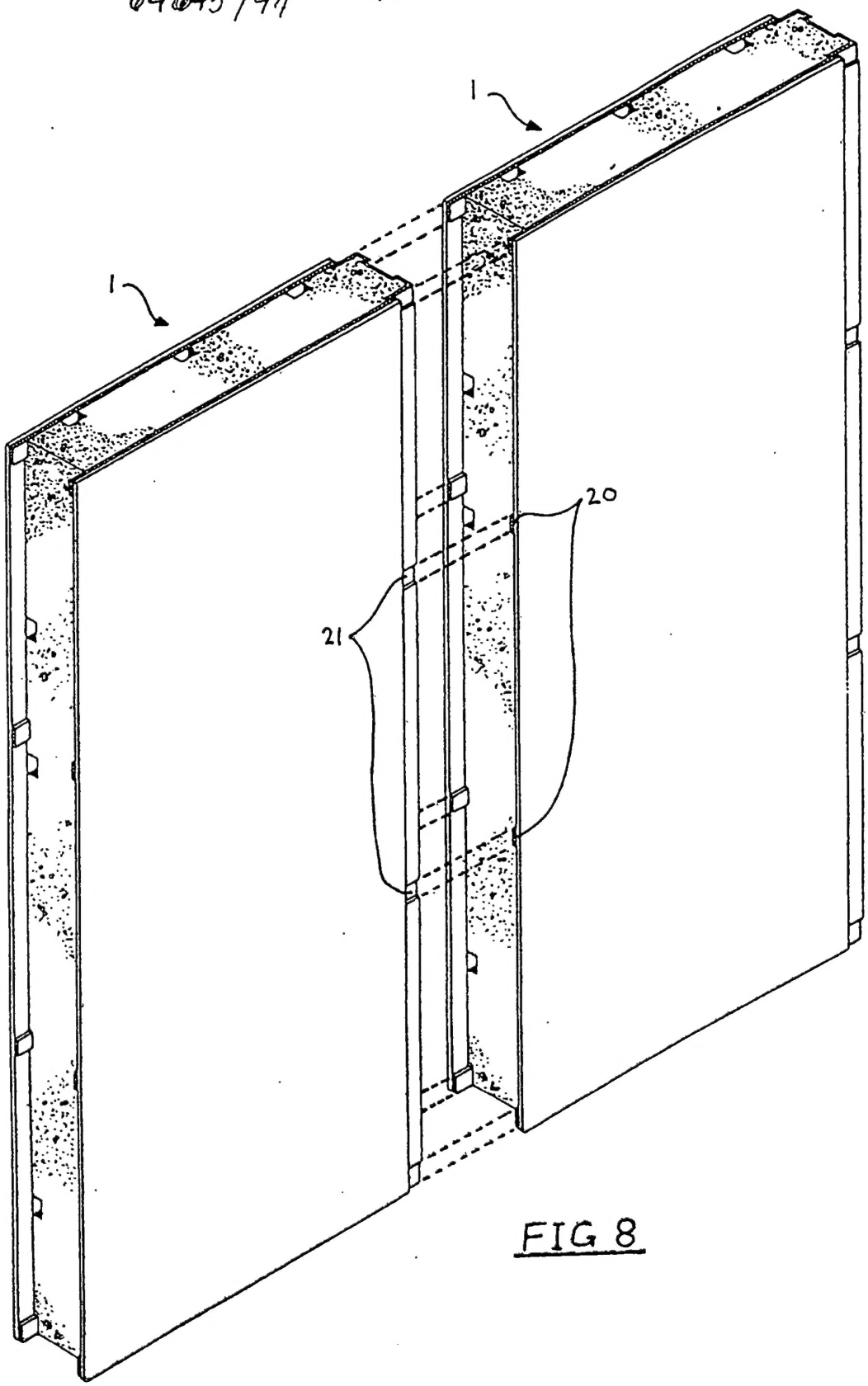

FIG 8